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death. In fine qualities of exposition and balance this part is a worthy companion of the first. In places, however, it suffers a little from an extreme of condensation, although its 189 pages (with their 81 illustrations) would seem to be ample for the subject in comparison with part I. Thus the treatment of capillarity (pp. 314, 349) and of osmotic phenomena (p. 309) is too brief for complete clearness. And (while we are faultfinding) the inference (p. 371) as to the wastefulness of the plant motor does not follow from the evidence; and surely the protoplast is not dragged, but pushed, from the wall (p. 310), and it is settled that the products of decomposition of chlorophyllin have nothing to do with reddening the leaves (p. 368). But it is upon such trifles as these that the fiendish glee of the reviewer in the detection of error must glut itself in this book, and their very insignificance is eloquent testimony to the general accuracy and worth of the work, which offers an unsurpassed synopsis of the present state of our knowledge of plant physiology.

This part, and in lesser degree the first, reflects the efforts of the authors to give more exact definition to terminology, especially in the direction of elimination of teleological expressions. The result is, however, not always happy, and it is a question whether it is not better in most cases to retain the familiar and expressive, even though teleological and animistic, terminology, giving frequent warning to the student as to its scientifically erroneous character.

Every teacher will wish to know to what grade of instruction the work is adapted. Presumably part III will correspond in this respect to those before us. The title shows that it is intended "for colleges and universities." If by colleges is meant the general elementary courses in which botany is presented for the first time to undergraduates, then in the opinion of the reviewer the book contains too much, and is of too advanced a character, unless the plan is followed of irrigating the student mind with a vast flood of information in the hope that out of the profusion he will find and retain something that interests him. But for the second courses in colleges, those devoted to morphology, physiology, and ecology in particular, the work seems to the reviewer wholly admirable, and much better adapted than any other to the needs of American college students and our methods of instruction. For this purpose, however, the parts should be obtainable separately, and the physiology would have borne some amplification.

The book is beautifully printed, and the excellent illustrations are admirably reproduced. Altogether it is mechanically, as it is in substance, one of the most attractive of textbooks.—W. F. GANONG.

Lichens of Minnesota

Professor BRUCE FINK has been studying the lichens of Minnesota since 1896, and the result has appeared in the form of a large bulletin from the U.S. National Museum.² It is a notable contribution to the lichenology of North

² FINK, BRUCE, *The lichens of Minnesota*. Contrib. U.S. Nat. Herb. **14**: pt. 1. pp. xvii+269. pls. 51. figs. 18. 1910.

America, for although it includes only the forms of a single state, the peculiarly wide distribution of species of lichens makes the bulletin really a manual for the determination of the lichens of the whole country. The bulk of the bulletin consists of the catalogue of species, but it is much more than that, for the species are described with a fullness and an exactness unusual in such descriptions, and convenient keys make the approach to genera and species seem simple enough. The numerous admirable reproductions of photographs also bring clearly to the student the field aspect of the different forms.

There are 68 genera presented, comprising 314 species, and under the species there are often numerous varieties. It is of interest to note that the genera are not large, only 6 of them comprising 10 or more species, and the 2 largest (*Lecidea* and *Cladonia*) comprising only 29 species each. This means that the remaining genera are represented on the average by about 3 species. This is a striking illustration either of the constancy of lichen species over wide areas, or of the caution of lichenologists in recognizing variations as species. This is perhaps further emphasized by the fact that in the present publication not a single new species is proposed.

The catalogue is preceded by a general account of lichens, so that the student of classification may obtain adequate information as to the morphology of the group. There are also some interesting paragraphs dealing with the economic rôle of lichens, under the following heads: "as purifiers of the air," "as aids in rock disintegration," "as food," "as medicinal agents," "as dyestuffs," and "as related to the welfare of trees."

This book should prove a great stimulus to the study of lichens, a group which deserves to be more cultivated by American botanists.—J. M. C.

MINOR NOTICES

Plant-breeding in the United States.—Professors v. RÜMKER and v. TSCHERMAK have published a report³ of their extended American visit during the spring and summer of 1909. The writers inspected most of the institutions in which either theoretical studies in genetics, or practical experiments in plant and animal breeding are in progress, as well as the work of numerous private breeders. The whole report forms an exceedingly keen and accurate review of the present operations along these lines in America. The material has been well sifted, analyzed, and systematically arranged. The chapters close with full bibliographies. In the first part, which is occupied with American studies in genetic theory, full reviews are given of the newer work of SHULL, CASTLE, TOWER, MORGAN, MACDOUGAL, and others. Part II, dealing with practical breeding operations, begins with an extended discussion of American experiment station investigations in corn breeding. The long-continued experiments at the Illinois station on the

³ RÜMKER, v., and TSCHERMAK, v., *Landwirtschaftliche Studien in Nord-Amerika, mit besonderer Berücksichtigung der Pflanzenzüchtung*. pp. 150. Berlin: Paul Parey. 1910.